

Seminar on Mathematical Statistics - Asymptotic Minimax Theory

Prof. Dr. Axel Munk

Winter term 2026/27

Key information

When?	30.10.2026 – 12.02.2027, on Fridays, 10.15-12.00
Where?	Seminar room 5.101 (IMS)
Eligible Modules:	B.Mat.4444: Seminar on mathematical statistics B.Mat.4447: Seminar on asymptotic statistical methods for data science M.Mat.5440: Seminar on statistical methods for machine learning M.Mat.5444: Seminar on mathematical statistics M.Mat.5447: Seminar on statistical foundations of data science
Instructors:	Prof. Dr. Axel Munk and Markus Zobel
Intended Audience:	Beginning to intermediate Master students
Language:	English

Prerequisites

Participants must have successfully attended either

- Measure & probability theory (B.Mat.1400 (old)), or
- Measure & probability theory (B.Mat.1014) together with "Elementare Wahrscheinlichkeitsrechnung und statistische Datenanalyse" (B.Mat.0024), or
- have an equivalent qualification (from another university).

Intermediate knowledge of Statistics (e.g. Statistical Foundations of Data Science (e.g. B.Mat.4147)) and/or of stochastics (e.g. B.Mat.2410 (old) B.Mat.1024 (new)) is highly recommended. Basic knowledge of functional analysis is helpful.

This seminar accompanies my lecture M.Mat.5140 on "Statistical Learning I".

Description

In this seminar we will learn about a central topic in mathematical statistics:

How to define and find an optimal estimator and how to prove that?

Meanwhile, a comprehensive theory has been developed which offers some obvious and some quite surprising answers in a variety of statistical models: Beginning with simple finite dimensional parametric models we will learn about minimax and Bayes-optimal estimators and techniques to prove their optimality. A central role play lower information bounds which will be derived in suitable metrics (such as

the Hellinger-metric) which are designed to capture the difficulty of a statistical model. Basic examples include classical maximum likelihood estimators for mean and variance and other parameters of a model. Then we will discuss irregular models, which have an entirely different (asymptotic) behavior. This includes change point estimation, where maximum likelihood fails and only certain Bayes estimators will be shown to be asymptotically optimal. In the second part of the seminar we will progress to function estimation in infinite dimensional models, including kernel and local polynomial estimators in nonparametric regression and their asymptotic minimax optimality.

We will combine theoretical analysis with computational illustrations and examples. Material will be complemented by selected exercises.

The seminar will continue next term and may serve as the first part of a possible preparation for a Master thesis in Mathematical Statistics.

Application and Schedule

To provide participants with the material to be presented at an early stage, we ask you to preregister for this seminar. To this end, please email Markus Zobel (markus.zobel@uni-goettingen.de) and indicate your interest to give a seminar talk. Please include information about relevant courses you have completed in your email. **The deadline for preregistration is Sunday, August, 30th, 2026.**

A preparatory virtual meeting, during which topics will be assigned to participating students, is scheduled for **Friday, September 4th, 2026, 10.15.**

Notably, the seminar is limited to a maximum of 14 participants. Should pre-registrations exceed this number, then participants will be chosen based on the information provided in their preregistration email.

Recommended literature

Main Reference

Topics for presentations will be assigned along the lines of some chapters in

- Korostelev, A., Korosteleva, O. (2011), *Mathematical Statistics - Asymptotic Minimax Theory, Graduate Studies in Mathematics, Vol. 119*, American Math. Society, Providence, Rhode Island.

Available from the university network here.

References for further reading

- Tsybakov, A. B. (2009), *Introduction to Nonparametric Estimation*, Springer.
- Wasserman, L. (2005), *All of Nonparametric Statistics*, Springer.